NET PEN FINFISH AQUACULTURE IN BRITISH COLUMBIA

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Economic Development Branch
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Prepared by:

AXYS Environmental Consulting Ltd.
P.O. Box 2219, 2045 Mills Road
Sidney, BC V8L 3S8

Contact: Nick Poushinsky
250-655-2280; npoushinsky@axys.net

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BUILDING BLOCKS FOR ECONOMIC DEVELOPMENT & ANALYSIS

PREFACE

PURPOSE

Building Blocks have been conceived and developed by the Economic Development Branch of the Ministry of Sustainable Resource Management, under the guidance of Nancy South, Manager Economic Analysis, as an analytical tool that supports British Columbia coastal and land and resource use planning and decision-making and economic development initiatives. The Blocks contain concise business and sector information for a broad range of resource-based business types in BC. At this point, there are more than 30 Blocks either complete or in draft form. Several more Blocks have been identified as high priority by planning tables and other client groups. Additional Building Blocks will be developed over time, and some Blocks may be updated. For the most current Building Blocks, please see the Ministry of Sustainable Resource Management website, at: http://srmwww.gov.bc.ca/rmd/ecdev/

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BENEFITS

Building Blocks are expected to provide the following general benefits:

- Increase efficiency and more informed decision-making by providing readily accessible, credible information to planning and economic development processes;
- Improve the consistency of economic information across planning areas;
- Support economic analysis and decision-making that occurs outside formal coastal and land use planning processes; and
- Provide linkages between economic analysis and other social and environmental analytical tools (through identifying resource requirements to support economic activities and general compatibilities with other sectors and values).

LIMITATIONS

Every effort has been made to ensure that the information contained in Building Blocks is accurate and consistent. Approved, credible data sources are the foundation for Building Blocks. All Blocks were reviewed by sponsoring agencies and other experts. However, users are cautioned that information is used at their own risk, and that the authors and sponsors are not liable for any damages. Any conclusions or interpretations by the authors are not intended to represent government policy. Also, note that Building Blocks do not provide site specific information nor do they consider requirements for sustainability (social, community, environmental).

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RECOMMENDED REFERENCE/CITATION

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1.0 INTRODUCTION

One of the goals of the Ministry of Sustainable Resource Management (MSRM) is the economic diversification of British Columbia's coastal regions. To this end, the province continues to investigate the expansion of the aquaculture industry. This expansion cannot, however, occur in isolation and planning is essential for achieving social, economic and environmental sustainability along the coast.

Provincial government planning for the coastal zone focuses mainly on nearshore and foreshore areas and planning products are intended to address tenure, and conservation and protection issues in these areas. A number of planning-related initiatives are underway to address economic development and diversification, coastal threats, land and resource conflicts, First Nations issues, and support informed decision-making in the coastal zone. For example, the Economic Development Branch of MSRM is developing a suite of economic building blocks as an analytical tool intended to facilitate coastal land use decision-making processes. These economic building blocks inform decisions through economic analysis and economic development planning. This report presents the economic building block for net pen finfish aquaculture in British Columbia.

2.0 ECONOMIC BUILDING BLOCK

2.1 Overview of the Business Opportunity

Business opportunity: farmed Atlantic and Pacific salmon using the traditional net pen grow-out (marine) system with or without associated land-based hatchery (freshwater) facilities.

Areas of present activity: coastal foreshore and marine waters in the Vancouver Island and South Coast regions.

Areas where business opportunities could be developed: coastal foreshore and marine waters in the Central Coast, North Coast and Queen Charlotte Island regions.

Products: Atlantic and Pacific salmon predominately for the whole fish (head on) fresh or frozen markets, but also for added-value products such as fillets fresh or frozen, steaks, smoked salmon and patés.

Production process:

- **Operations with associated hatchery**: 1) spawn broodstock; 2) egg incubation; 3) rear fry to smolt stage; 4) transfer smolts to net pen system; 4) grow-out to harvest size (>2 years); 5) direct sale of fresh fish to processors or contract processing and direct sale to restaurants and retail food outlets.

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- **Operations with no hatchery**: 1) purchase smolts for introduction to net pen system; 2) grow-out to harvest size (>2 years); 3) direct sale of fresh fish to processors or contract processing and direct sale to restaurants and retail food outlets.

Associated businesses:

- *Smolt producers:* independent or contract hatcheries
- *Transportation:* marine transport, ground transport, air transport.
- *Processing:* seafood processors, packaging and shipping.
- *Supplies and manufacturing:* net pens and docks; net, rope and twine; fish feed; predator deterrents, composting facilities, repairs and maintenance; utilities and fuel supply; container and box manufacturers, metals and plastics; construction firms; marine chandlers; machinery, hatcheries.
- *Professional services:* contract divers, veterinarians, pharmacists, lab technicians, research scientists, environmental analysts, accountants, lawyers, architects, insurance brokers, financial managers and bankers, software programmers.
- *Government:* regulatory agencies, site inspectors (WCB, WLAP).
- *Marketing, sales and administration:* fish brokers, marketing and promotion, store sales, office and administration staff.

2.2 Profile of Existing Net Pen Salmon Aquaculture Industry: Tenures and Licensees

- Number of tenures[1]: 121
- Number of active tenures[2]: 103
- Distribution of tenures by Regional Districts (as percent of all active tenures[3]):

Comox-Strathcona	35%
Mount Waddington	27%
Alberni-Clayoquot	23%
Nanaimo, Cowichan Valley and Capital	10%
Sunshine Coast and Powell River	5%

- Total area of tenures[4]: 1191 ha
- Average tenure size: 9.8 ha
- Total area of active tenure[5]: 1009 ha
- Number of parent companies (owners)[6]: 12
- Number of licensees (operators or owner-operators)[7]: 30

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[1] Number of tenures in 2001 (BC Fisheries 2000b; MAFF 2001)
[2] Varies annually – for purpose of this report considered 85% of tenures to be active (K. Stinchcombe, MAFF, pers. comm., July 2002)
[3] 1996 figures (EAO 1997)
[4] BC Fisheries 2000b
[5] 103 X 9.8 ha
[6] BC Fisheries 2000b; MAFF 2001
[7] MAFF 2001

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- Number of tenures per licensee[8]: 4
- Number of active tenures per licensee: 3.4
- Area of active tenure per licensee: 33.3 ha

2.3 Profile of Existing Net Pen Salmon Aquaculture Industry: Production and Revenues

- Distribution of production by species[9]:

  Atlantic salmon: 80%
  Chinook salmon: 18%
  Coho salmon: 2%
- Total tonnes produced[10]: 46,900
- Tonnes per active tenure: 455
- Tonnes per licensee[11]: 1563
- Production Revenue:

  Total farmgate value[12]: $281.7 million
  Farmgate value per tonne: $6000

Government revenue sources: rent on Crown aquatic and tenures; business taxes and other payments (e.g., sales tax, permits and licenses); employment taxes and payments (e.g., WCB, CPP).

3.0 INFRASTRUCTURE REQUIREMENTS

On-site (farm)[13]: net pens, docks, land-based or floating outbuildings (e.g., feed storage shed), land-based or floating living quarters, hatchery (optional – land-based), freshwater supply, land-based composting facility.

Off-site:

- *Transportation:* marine dock facilities, roads, ferries, airports
- *Energy:* electricity, gasoline, diesel, propane, natural gas
- *Communications:* telephone, VHF radio, fax, internet

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[8] Note that there are some parent companies/licensees that only own single tenures
[9] Varies annually, generalised from information in: Coopers & Lybrand 1998; BCSFA 2000; BC Fisheries 2000b
[10] Mean harvest 1998-2000 (BC Fisheries2000b)
[11] Note that some licensees produce much less than this (i.e. < 500 tonnes) while other produce >2000 tonnes (EAO 1997)
[12] Average for 1998-2000 (MFCR 2001a)
[13] Land-based infrastructure is typically on private land

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4.0 COAST/LAND RESOURCE REQUIREMENTS AND SENSITIVITIES

Crown resource requirements: nearshore, foreshore, foreshore access, adjacent freshwater sources.

Sensitivities[14]:

First Nations land use and jurisdiction; parks and protected areas; ecological reserves; recreational and commercial fisheries; salmonid-bearing streams; herring spawning areas; shellfish aquaculture; other salmon aquaculture operations; public harbour, wharf or dock facilities; sites of cultural or heritage significance; sensitive fish habitat; significant marine mammal areas; upland property owner rights; local land use planning and zoning by-laws.

Thresholds:

- *Biophysical:* water temperature, water depth, salinity, dissolved oxygen, circulation (tidal flushing), shelter from storms, algal bloom frequency
- *Logistical:* distance to markets, distance to amenities, employee availability

Relationship with other resource sectors and values:

- *Conflicting relationships:* First Nations entitlements, recreation (e.g., pleasure boating and kayaking), tourism (e.g., wildlife viewing), subsistence activities (e.g., aboriginal clam harvest), aesthetics, recreational and residential property owners and developers, commercial and recreational fisheries, shellfish aquaculture
- *Complementary relationships:* recreation (e.g., pleasure boating); public education; heritage (coastal culture appreciation)

Environmental Issues:

Benthic community impacts (e.g., smothering from sediment deposition), antibiotic use, wildlife impacts (increased mortality risk, sensory disturbance), Atlantic salmon escapement, disease and parasite transfer, disposal of mortalities.

Resource capability:

Percent of waterways given a salmon farm suitability rating of good or medium[15]:

Central Coast:	43%
North Coast and QCI:	46%
Western Johnstone & Queen Charlotte straits, W. Vancouver Is:	43%
South Coast	not rated[16]

[14] Derived from Schedule C of Commercial Finfish Aquaculture Management Plan (BC Fisheries 2000a).
[15] Derived from Cooper & Lybrand 1998
[16] Most of the farms originally in this area have relocated, limited 'good' areas (Cooper & Lybrand 1998)

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5.0 REGULATORY REGIME

Relevant legislation:

- *Provincial: Fisheries Act* – Aquaculture Regulations, *Farm Practices Protection* (Right to Farm) *Act*
- *Federal: Fisheries Act, Navigable Waters Protection Act, Cumulative Effects Assessment Act*

Primary tool for industry regulation: Commercial Finfish Aquaculture Management Plan

Number of agencies involved in some aspect of new tenure approval process: multiple (>14[17])

Interval between application[18] and approval of new tenure: target turnaround time is 140 calendar days

Tenure application fee: $100

Estimated cost of fulfilling requirements of Commercial Finfish Aquaculture Management Plan: >$10,000

Period of tenure: initially a 5-year licence of occupation is issued until the site is determined by the Province to be viable, at this time a 20-year licence or 30-year lease will be offered.

Annual rent on Crown aquatic land tenure: $324-$563[19] per ha (depending on land value zone)

Licences/permits required: multiple (e.g., aquaculture licence, waste permit)

Aquaculture licence fees[20]: initial cost $225, and then annual cost of $200

Operational plans required: escape prevention plan, escape response plan, predator avoidance plan

Monitoring requirements/expectations: WLAP site inspections, WCB site inspections, environmental monitoring as specified in Commercial Finfish Aquaculture Management Plan

Opportunities for new tenures: a moratorium on new tenures was lifted in April 2002, but at present, applications are limited to: current tenure holders that have been notified that they must relocate and government approved experimental operations (green technology).

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[17] BCSFA 2000
[18] Submitted to Land and Water British Columbia Inc.
[19] There is a 60% discount for new farms in the first three years of their tenure
[20] Administered by MAFF

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6.0 PRODUCT MARKET

Distribution of sales by market[21]:

United States:	70%
British Columbia:	10%
Canada (outside BC):	10%
Asia (predominately Japan):	10%

Access to markets:

- *Costs:* marketing and promotion, transportation
- *Barriers:* higher labour and feed costs relative to competitors (e.g., Chile)[22]
- *Advantages:* relatively close proximity to Asian markets and the best US markets (e.g., California) in comparison to competitors (e.g., Norway, Chile)

Industry marketing organisations: BCSFA, Salmon Marketers International

Market demand: increasing[23]

7.0 LABOUR MARKET

General skill requirements: varied, significant proportion of positions are entry-level

Specific (on-site) labour requirements: 3-5 FTEs for a typical farm – a site manager and 2-4 farm workers; an associated hatchery facility may require additional workers at certain times of the year

Seasonality: generally year-round

Annual wage range: $10-$20 per hour

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[21] Varies annually, these figures generalised from information in: EAO 1997; BCSFA 2000; BC Fisheries 2000b; MFCR 2001a

[22] EAO 1997

[23] Ellis and Associates 1996; Coopers & Lybrand 1998; PWC 2000

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8.0 INVESTMENT REQUIREMENTS

Start-up capital requirements: nets, net pens, anchors, docks, stock (i.e. broodstock, smolts, eggs), barges, boats, trucks, equipment, hatchery facilities, and outbuildings

Start-up capital costs for a typical farm[24]: >$1 million

Start-up non-capital requirements: preparation of new tenure application (includes cost of actual application plus attendant costs associated with design drawings, biophysical reports, etc.), feed, insurance, employees, advertising, boxes and containers, therapeutants, energy, water, rentals and leasing, and various professional services
Start-up capital costs for a typical farm[24]: >$1 million

Ongoing non-capital costs for a typical farm[24]:

- *Non-capital items:* feed[25], insurance, employees, processing, advertising, boxes and containers, therapeutants, energy, water, rentals and leasing, various professional services, repairs and maintenance, transportation, travel, property taxes, contract divers, environmental monitoring, research and development, and depreciation
- *Annual non-capital costs:* >$1 million

Ongoing capital costs for a typical farm[24]:

- *Capital items:* nets, stock, and equipment.
- *Annual capital costs:* >$150,000

Future capital requirements: infrastructure improvements

9.0 CAPACITY FOR GROWTH

Resources required: appropriate sites, suitable labour pool, transportation infrastructure, suitable and vigorous stock

Constraints on resource availability:

- *Appropriate sites:*
  - Biophysical constraints: biophysical thresholds (see Section 2.2)
  - Planning constraints: Coastal planning processes (e.g., Coastal Zone Management Plans), local area use plans, LRMPs, local government land use and zoning by-laws
  - Regulatory constraints: siting criteria[26]
- *Suitable labour pool*: high labour costs

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[24] 10-30 net pens (EAO 1997)
[25] Up to 40% of operating costs are feed (EAO 1997)
[26] Commercial Finfish Aquaculture Management Plan (BC Fisheries 2000a)

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- *Transportation infrastructure*: increasing costs with increasing remoteness of sites
- *Stock*[27]: limited number of Atlantic salmon lineages available, high smolt costs

Growth facilitators: new tenure process, good environmental conditions for growing salmonids, skilled labour pool locally available, technical expertise locally available, positive market trends, added-value products (e.g., fillets)

10.0 INPUT/OUTPUT TABLE

This input/output table presents economic coefficients for an average net pen salmon farm located in the Vancouver Island or south coast region. These coefficients will vary depending on factors such as site suitability, farm size, remoteness of location, and operator experience. Additionally, all three salmon species have been considered together in this example. Operations are basically the same regardless of which species is under production; however, it is important to note that Atlantic salmon generally have better growth and can be farmed at higher stocking densities than chinook salmon.

Indicator	Estimated coefficients (per ha of Crown tenure[28]) for net pen salmon aquaculture operation	
	Without on-site hatchery	With on-site hatchery
Tenure size	9.8 ha	9.8 ha
Initial investment	>$90,000 per ha	>$100,000 per ha
Annual operating costs[29]	>$150,000 per ha	>$150,000 per ha
Annual sales (farmgate[30])	$257,610 per ha[31]	$257,610 per ha[31]
Direct employment	0.41 FTE per ha[32]	0.46 FTE per ha[33]
Rent on Crown aquatic land tenure	$445 per ha[34]	$445 per ha[34]

[27] Coopers & Lybrand 1998
[28] Based on total area of active tenures (i.e. 1009 ha)
[29] Annual operating costs for operations with or without hatcheries do not differ as costs of raising smolts vs. purchasing smolts (approximately $2 per smolt) were assumed to be comparable.
[30] Average price per kg for farmed salmon during the 1990s was $5.54 – in the same period Atlantic salmon was $6.13 per kg, chinook $5.59 per kg, and coho $4.46 per kg, trend has been for a decrease in Atlantic salmon price and an increase in Pacific salmon price (MCFR 2001b)
[31] Based on production of 46.5 tonnes per ha and a price of $5.54 per kg
[32] Based on 4 FTEs for a typical farm
[33] Based on requirement for additional 0.5 FTE for hatchery operations
[34] Average of range for different land value zones

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11.0 DISCUSSION

This building block has been prepared for net pen aquaculture of finfish, specifically Atlantic salmon, chinook salmon and coho salmon, along the coast of Vancouver Island and the southern mainland. This building block was derived from available data that indicates measures for the industry as a whole. Information for individual tenures was not available and analysis on a Regional District basis was limited. Future refinement of this building block may include developing separate building blocks for small-scale and large-scale operations.

Expansion of the finfish aquaculture industry to other regions along B.C.'s coast would require a re-evaluation of the appropriateness of this building block to those regions, as parameters such as species farmed, transportation costs, and employee availability may vary. Additionally, the eventual commercial production of non-salmonid finfish would likely require a new building block, as would trout aquaculture and land-based (tank) marine aquaculture.

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